

Comparison of Coprological and Postmortem Examinations Techniques for the Determination of Prevalence and Economic Significance of Bovine Fasciolosis

Mulat Nega¹, Basaznew Bogale¹, Mersha Chanie¹, Achenef Melaku², Tewodros Fentahun^{2*}

¹Department of Paralinical Studies, ²Department of Basic Veterinary Science, Faculty of Veterinary Medicine, University of Gondar, P.O.Box 196, Gondar, Ethiopia.

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Abstract

Cross-sectional study was done to determine the prevalence and economic significance of fasciolosis at Gondar ELFORA abattoir using coprological and abattoir survey. A 6 year database (2005-2010) from the abattoir was retrieved and analyzed. Faecal samples from randomly selected 400 cattle were examined using sedimentation technique and postmortem. Among 400 livers and faecal samples examined, 119 (29.75%) and 76 (19.5%) were positive for adult fasciola parasites and eggs respectively. Species identification revealed that *F. hepatica* was more prevalent (79.8%) as compared to *F. gigantica* (14.28 %). Some animals (5.88%) were harboring mixed infections. Animals of poor body condition (40%, n=50) were positive for Fasciola. Results from the retrospective study revealed that out of 33, 256 examined livers 8,830 (26.55 %) were condemned due to fasciolosis. Based on present local price of liver, the total economic loss through condemnation accounts 32, 075.41 Eth. Birr (US\$ 2,566) annually. This indicated that Fasciola infection is an important condition that leads to high liver condemnation rates consequential into high economic loss. Therefore, additional work on this parasite on live animals of different age, species, breeds and economic aspects should be accomplished.

Keywords: Abattoir survey; Cattle; Coproscopy; Economic significance; Fasciolosis; Prevalence

Introduction

Fasciolosis caused by *Fasciola hepatica* and *Fasciola gigantica*, is one of the most prevalent helmenth infections of ruminants in different parts of the world including Ethiopia (Okewole *et al.*, 2000; WHO, 1995). In cattle it occurs commonly as a chronic disease and of the severity often depends on the nutritional status of the host (Graber, 1978). Fasciolosis causes a substantial economic loss which includes; death, loss in carcass weight, reduction in milk yield, condemnation of affected liver, decline production and productive performances, predispose animals to other disease and cost of treatment expense. Both *F. hepatica* (high land) and *F. gigantica* (low land) type of liver flukes cause sever losses in Ethiopia where suitable ecological conditions for the growth and multiplication of intermediate host snails are available (Anne *et al.*, 2006).

In Ethiopia, *F. hepatica* and *F. gigantica* infections occur in areas above 1800 meters above sea level and below 1200 meters above sea level, re-

spectively which has been attributed to variations in the climatic and ecological conditions such as rain fall, altitude, temperature and livestock management system (Yilma and Malone, 1998). The presence of fasciolosis due to *F. hepatica* and *F. gigantica* at abattoir surveys in some parts of the country has long been known and its prevalence and economic significance have been reported by several workers (Abunna *et al.*, 2010; Gebretsadik *et al.*, 2009; Tadele and Worku, 2007). But there is still a gap for many potential sites of the country and information is not available to review country wide prevalence and economic significance. Therefore, the objectives of this study were to determine the prevalence and economic significance of bovine fasciolosis; identify species involved and evaluate the technique used for the detection of fasciola (eggs and adult parasite).

Materials and methods

Study area:

The study was conducted at ELFORA industrial abattoir located in Gondar which is located on northwest parts of Ethiopia. Animals were brought

*Corresponding author: Tewodros Fantahun

Address: Department of Basic Veterinary Science, Faculty of Veterinary Medicine, University of Gondar, P.O.Box 196, Gondar, Ethiopia.

E-mail address: tewodros.fantahun@yahoo.com

to the abattoir from areas located on 3507' N and 1308' E., at an altitude of 2200 meter above sea level which receives a mean annual rain fall of 1172 mm. The mean monthly temperature of the area was 19.70C (SGZRAD, 2011).

Study population:

The present study involved cattle slaughtered at Gondar ELFORA industrial abattoir. Cattle were bought from different cattle markets around Gondar. The slaughtered animals were all local breeds (Zebu) and castrated males over 6 years of age which reflects their primary function as draught animals and the fact that they are slaughtered when they are considered too old which were almost unable to work.

Sampling method and sample size:

Simple random sampling technique was used. The required sample size was calculated based on the expected prevalence of 50%, absolute desired precision of 5% and at confidence level of 95% according to the formula provided by Thrusfield (2007). As a result, a total of 384 cattle were sampled; however, to increase the precision the number of sampled animals was increased to 400.

Study design:

A cross-sectional and retrospective study of bovine fasciolosis was conducted at Gondar ELFORA abattoir from October 2010 to March 2011. In addition, primary data were also collected by performing inspection of animals before and after slaughter at the abattoir and by coprological examination of their fecal sample. For species identification, one or more samples of the worms were collected from 125 livers which had active infection. A preliminary identification was done through observation of the morphology as described by Soulsby (1982).

Collection of faeces and examination:

Faecal samples were collected directly from the rectum of the animals. The samples were taken to the laboratory in tightly closed universal bottles and examined for Fasciola eggs using sedimentation method described by Hansen and Perry (1994).

Postmortem examination:

Active abattoir survey was conducted during routine meat inspection on randomly selected cattle. A total of 400 cattle were examined during the study. During meat inspection, the previously identified animals and their livers were carefully supervised and examined so as to avoid mixing up the organs to be inspected and the fecal samples. Liver inspection was carried out by visual examination and incision of the organs (FAO, 2003). For Identification of Fasciola species involved was carried out using the morphology and size parameters described by Soulsby (1982).

Retrospective study:

A retrospective study design was focused on retrieval and analysis of secondary data on previous meat inspections carried out between September 2005 and August 2010. Data focused on the number of livers condemned due to Fasciola infection in cattle slaughtered during the period of reference. The parameters used to estimate the losses attributable to liver condemnations in slaughtered cattle were the average number of cattle slaughtered to the period 2005 to 2010, the prevalence of bovine fasciolosis, the average weight (expressed as Kg) of liver in a mature cattle and the selling price of the livers (expressed as Eth Birr/Kg of liver). The average selling price of cattle liver was established through a survey in various butcher houses in Gondar town. A total of 50 livers from cattle were weighed immediately after slaughter using weighing balance to get average weight.

Data analysis:

The data collected during the study period were stored in Ms-Excel spreadsheet for statistical analysis. The data were analyzed using SPSS version 17.0 software for windows 2000. The variables used were the cases of fasciolosis detected during routine postmortem inspection and faecal examination of Fasciola eggs.

Results

In this study, out of the 400 cattle examined, 119 (29.75 %) revealed the presence of Fasciola species. Among these, 95(79.83%) were infested

with *F. hepatica*, 17(14.25%) by *F. gigantica* and 7 (5.88%) had mixed infection (Table 1). A statistically significant difference ($P < 0.05$) was observed between the prevalence of the two *Fasciola* species. Of the 400 cattle subjected to both faecal and liver

examination, 76 (19.5%) were positive for *Fasciola* eggs while 119 (29.75%) had adult flukes, which showed us that the sedimentation technique used for *Fasciola* egg assessment was failed to detect eggs from some faecal samples.

Table 1. Prevalence of fasciola species based on abattoir survey from the total positives (n=400)

Species	No. positive	Prevalence (%)
<i>F. hepatica</i>	95	79.83%
<i>F. gigantica</i>	17	14.28%
Mixed (<i>F. hepatica</i> and <i>F. gigantica</i>)	7	5.88%
Total	119	29.75%

The infection rate of fasciolosis based on body condition score was 40% (50/125), 28.4% (46/162) and 20.4% (23/113) in poor, medium and good, respectively. The relationship between body condi-

tion score and *Fasciola* infection rate indicated that highest prevalence was recorded on poor body condition score. The difference was statistically significant ($P < 0.05$) (Table 2).

Table 2. Evidences of bovine fasciolosis based on body condition scoring

Body condition Scoring	No of animals examined	No of positive animals	Prevalence (%)	P-value
Poor	125	50	40	0.002
Medium	162	46	28.4	
Good	113	23	20.4	
Total	400	119	29.75	

Retrospective results showed that a total of 33,256 cattle were slaughtered between September 2005 and August 2010. During that period, 33,256 (44.30%) livers were condemned due to various reasons. Fasciolosis was responsible for 59.92% of total liver condemnations (Table 1). The overall prevalence of fasciolosis was found to be 26.55%.

The maximum liver condemnation rate was 7.95% in the year 2007 and a minimum of 2.66% recorded in the year 2005 (Table 3). Based on the previous local price of liver, the economic loss incurred due to condemnation of livers infected with *fasciola* species was calculated to be 32,075.41 Ethiopian Birr equivalent to US\$ 2,566.00 per annum.

Table 3. Retrospective prevalence of bovine fasciolosis between 2005 and 2010 at Gondar ELFORA abattoir

Period	No. of slaughtered cattle	Condemned livers		Fasciolosis prevalence (%)
		Total	Due to fasciolosis	
2005	4741	2043	886	43.37
2006	6269	2780	1965	70.68
2007	6446	3724	2647	71.08
2008	5082	1835	1034	56.35
2009	4797	1800	962	53.44
2010	5921	2552	1336	52.35
Total	33,256	14,734	8,830(44.30%)	59.92

Discussion

The findings of this study indicated that fasciolosis is serious quandary in cattle slaughtered at Gondar ELFORA abattoir and thus causes high economic losses due to liver condemnations. The 29.75% prevalence of fasciolosis observed in this study is lower when compared to 46.58% of Tadele and Worku (2007) from Jimma and 41% of Getachew *et al.* (2006). One of the most important factors that influence the occurrence of fasciolosis in the area is the availability of a suitable habitat for the snail intermediate hosts and essential for the development of fluke eggs, miracidia searching for snails and dispersal of cercariae (Urquhart *et al.*, 1996). Yilma and Mesfin (2000) reported significantly higher prevalence of 90.95% on the same area. The current lesser prevalence result might be due to awareness of cattle owners and a wide use of anthelmintics. However, a similar result of fasciolosis (26%) was found from abattoir survey in Kenya (Mungube *et al.*, 2006). The current study result coincides with the reports of Gebretsadik *et al.* (2009) from Mekelle, Wakuma (2009) from Jimma and Wassie (1995) from Wellega.

Species identification revealed that *F. hepatica* was more prevalent (79.8%) as compared to *F. gigantica* (14.28 %). Similar findings were reported by Tadele and Worku (2007) and Wakuma (2009) from Jimma and Mulugeta *et al.* (2011) from As-sela of Ethiopia. This indicates the presence of relatively similar ecological and climatic conditions for the intermediate hosts and parasites larvae development. Studies from Africa, Phiri *et al.* (2005) in Zambia, (Mungube *et al.*, 2006) in Kenya and Wamae *et al.* (1998) in Kenya and Mage *et al.* (2002) in France reported *F. gigantica* as the most common species which infects cattle. However, Mekroud *et al.* (2004) reported *F. hepatica* as the major cause of liver condemnation in Algeria while Yilma and Malone (1998) reported both *F. gigantica* and *F. hepatica* to affect cattle in Ethiopia. This difference in species may depend on the common *Fasciola* species circulating in the local environment, differences in climatic conditions that are conducive to the intermediate hosts and the type of intermediate host snail present in the locality. The high prevalence rate of *F. hepatica* may be associated with the existence of favorable ecological biotopes for *L. truncatula*.

The 19.5% result of faecal examination is

higher than 4.9% and 12.4% recorded in Soddo and Kombolcha by Fufa *et al.* (2009) and by Ibrahim *et al.* (2010) in Kombolcha respectively. This might depend on the techniques used for sample collection, storage and processing of faecal materials. Similar findings have been reported by Braun *et al.* (1995) and Kumar *et al.* (2002), who compared the apparent prevalence of liver fluke infection, detected by liver, faeces and bile examination and found that examination of live or bile samples was more sensitive than faecal examination. On the other hand, Alasaad *et al.* (2008) and Phiri *et al.* (2005) reported similar value of necropsy and coprologic analyses for the diagnosis of fasciolosis on Iberian ibex and cattle, respectively. Nevertheless, sensitivity of the coprological technique proved to be higher (Rapsch *et al.*, 2006).

A significant variation was observed in the prevalence of fasciolosis among body condition scores. These results proved that as the weight of the animal increases the parasitic infection decreases. This could be due to acquired immunity in the host. This signifies the importance of fasciolosis causing weight loss and is a characteristic sign of the disease. Chronic fasciolosis is the commonest form of the disease in cattle and one of the characteristic sign is weight loss (Graber, 1978, Truncy, 1989, Urquhart *et al.*, 1996, Radostitis *et al.*, 1994). Other factors such as nutrition and other bovine pathogens should also be considered as the cause of loss of body condition.

The over all liver condemnation rate for fasciolosis for the 6-years retrospective data study was estimated to be 59.92%. Kithuka and his colleagues (2002) established a fasciolosis prevalence rate of 8% across Kenya from a retrospective abattoir survey spanning 10 years and a 9.3% prevalence estimate for the same from a 2-month meat inspection exercise at a slaughter house. These estimates were lower than the current study. A similar study in Zimbabwe, also indicated that a lower prevalence of 31.7 % (Pfukenyi and Mukaratirwa, 2004).

Based on the previous local price of liver, the economic loss due to liver condemnation was estimated at Ethiopian Birr 32,075.41 (US\$ 2,566) per annum. These results indicate that *Fasciola* infection is an important condition that leads to high liver condemnation rates in cattle slaughtered, resulting into high financial loss. Retrospective results showed that a total of 33,256 cattle were slaughtered between September 2005 and August

2010. During that period, 14,734 (44.30%) livers were condemned due to various reasons. Fasciolosis was responsible for 59.92% of total liver condemnations (Table 1). The overall prevalence of fasciolosis was found to be 26.55%.

Conclusion

This study demonstrated that bovine fasciolosis is prevalent in cattle in North Gondar. It causes great economic losses as a result of condemnation of infected livers. The study has also confirmed that *F. hepatica* accounts for the largest proportion of the causes of cattle liver condemnation at Gondar ELFORA industrial abattoir. In addition, this survey has helped to illustrate the usefulness of meat inspection records in monitoring disease situations and demonstrating possible long term trends. Generally from various points of view considering the prevalence of the disease and its economic significance in different part of the nations, one can strongly conclude that fasciolosis is one of the important livestock parasitic diseases, especially of cattle which imposes huge impact to farmers, butchers and consumers. For researchers involved in the diagnosis and study of Fasciolosis better if they depend more on the postmortem examination than faecal examination to accurately rule out Fasciolosis provided economically feasible.

Recommendations

In order to alleviate the existing problem and to promote the status of the livestock dependent people living in this area, the following recommendations were forwarded. Integrated approach with a combination of chemotherapy and vector control should be considered more practically and economically. Farmers should aware and informed about the importance of disease control programs and good management system if bright future and improvement in livestock production is needed. There is a need for more epidemiological investigations in animals of various sages, species and breeds and the economics of disease control to better determine the prevalence, economic impact and public health importance of the disease.

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